

We claim:

1. A method for decoding a multidimensional code, said method comprising the steps of:
  - 5 compensating for intersymbol interference caused by previously decoded multidimensional code symbols; and
  - compensating for intrasymbol interference caused by symbol components within the same multidimensional code symbol.
- 10 2. The method of claim 1, wherein a minimum decodable number of symbols is transmitted over more than one symbol interval.
3. The method of claim 1, wherein said multidimensional code includes a number of trellis code dimensions that exceeds a number of available channels.
4. The method of claim 1, further comprising the steps of:
  - calculating intersymbol interference estimates based on said previously decoded multidimensional code symbols;
  - calculating intrasymbol interference estimates based on possible data symbol values; and
  - 20 calculating branch metrics based on a received signal and said intersymbol interference and intrasymbol interference estimates.
5. The method of claim 1, further comprising the step of calculating a one-
  - 25 dimensional branch metric for an initial symbol duration of a multiple one-dimensional symbol duration sequence, wherein said initial symbol duration is not affected by intrasymbol interference.
6. The method of claim 1, further comprising the step of calculating a one-
  - 30 dimensional branch metric for subsequent symbol durations of a multiple one-dimensional

symbol duration sequence, wherein said subsequent symbol durations are affected by intrasymbol interference.

7. The method of claim 1, further comprising the step of calculating a two-dimensional branch metric based on said one-dimensional branch metrics.

8. The method of claim 7, further comprising the step of combining said two-dimensional branch metrics to calculate four dimensional branch metrics corresponding to the transitions in the trellis diagram for a 4D-TCM.

9. The method of claim 1, further comprising the step of determining a best surviving path into a trellis state.

10. The method of claim 1, wherein said multidimensional code is 4D-TCM.

11. A reduced state sequence estimation decoder for a multidimensional code, comprising:

at least one branch metric unit that calculates branch metrics for a received signal based on intersymbol interference and intrasymbol interference estimates, said at least one branch metric unit compensating for intrasymbol interference caused by symbol components within the same multidimensional code symbol; and

a decision feedback unit that processes survivor symbols to calculate the intersymbol interference estimates for different code states of said multidimensional code and channels used to transmit said multidimensional code.

12. The reduced state sequence estimation decoder of claim 11, wherein a minimum decodable number of symbols is transmitted over more than one symbol interval.

13. The reduced state sequence estimation decoder of claim 11, wherein said multidimensional code includes a number of trellis code dimensions that exceeds a number of available channels.

14. The reduced state sequence estimation decoder of claim 11, wherein said at least one branch metric unit is further configured to:

calculate intrasymbol interference free estimates based on possible data symbol values; and

calculate branch metrics based on a received signal and said intersymbol interference and intrasymbol interference estimates.

15. The reduced state sequence estimation decoder of claim 11, wherein said at least one branch metric unit is further configured to calculate a one-dimensional branch metric for an initial symbol duration of a multiple one-dimensional symbol duration sequence, wherein said initial symbol duration is not affected by intrasymbol interference.

16. The reduced state sequence estimation decoder of claim 11, wherein said at least one branch metric unit is further configured to calculate a one-dimensional branch metric for subsequent symbol durations of a multiple one-dimensional symbol duration sequence, wherein said subsequent symbol durations are affected by intrasymbol interference.

17. The reduced state sequence estimation decoder of claim 11, further comprising a two-dimensional branch metric unit to calculate a two-dimensional branch metric based on said one-dimensional branch metrics.

18. The reduced state sequence estimation decoder of claim 17, further comprising a four-dimensional branch metric unit to combine said two-dimensional branch metrics to calculate four dimensional branch metrics corresponding to the transitions in the trellis diagram for a 4D-TCM.

19. The reduced state sequence estimation decoder of claim 11, further comprising an add-compare-select unit to determine a best surviving path into a trellis state.

20. The reduced state sequence estimation decoder of claim 11, wherein said  
5 multidimensional code is 4D-TCM.

21. A system for decoding a multidimensional code, said system comprising:  
means for compensating for intersymbol interference caused by previously  
decoded multidimensional code symbols; and

10 means for compensating for intrasymbol interference caused by symbol  
components within the same multidimensional code symbol.

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